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ABSTRACT

The rapidity with which mothers respond to their infants' vocalizations by either vocalizing or verbalizing was compared for five male and five female later-born, (i.e., not first-born) children and their mothers. Videotapes were made from behind a one-way mirror when infants were 2, 26, 52, and 78 weeks of age; each tape represented a five-minute free play session in which mothers were instructed to play with their children as they normally would at home. Results showed that while the amount of maternal speech was similar for boys and girls at 2 weeks of age, mothers vocalized and verbalized more to daughters than to sons at 26, 52, and 78 weeks of age. It was also found that while mothers responded more quickly to their sons' utterances at 2 weeks of age, they responded more quickly with a vocalization to their female children's vocalizations at 26, 53, and 78 weeks of age. For girls there was a high correlation between frequency of vocalization and rapidity of maternal vocal response at all four ages. For boys there was no correlation between frequency of vocalization and rapidity of maternal vocal response at 2, 26, and 78 weeks of age and a significant negative correlation between the two at 52 weeks. It was concluded that the frequency of boys' vocalization apparently is independent of maternal responsiveness and that girls are more influenced by maternal or vocal reinforcement than are boys. Data from five additional mother/infant dyads in which the mothers were emotionally disturbed formed the basis for claiming that the measure of maternal responsiveness used in this study was a valid measure of the broader concept of maternal sensitivity. (JMB)

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MATERNAL RESPONSIVENESS AND INFANT VOCALIZATION

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The data presented in this paper represents one aspect of an analysis of the effect of maternal sensitivity in the early mother-child interaction upon individual differences in child behavior. This is part of a longitudinal study, the Infant Study Project, investigating ego development in early childhood. One important approach to studying the impact of individual differences upon development is to study sex differences. A body of literature is developing which convincingly points to dramatic biologic or genetic sex differences present as early as birth and in the early months of life (Freedman, 1974).

The measure of maternal sensitivity of special interest in the present analysis is "maternal responsiveness" or the rapidity with which the mother responds to her infant's vocalizations by either vocalizing or verbalizing (referred to as vocalization throughout this paper). Conditioning studies have demonstrated that rapid reinforcement of infant vocalizations by the mother is related to increased frequency of infant speech (Rheingold, Gewirtz, & Ross, 1959; Schaffer, Collis, & Parsons, 1977). The question of interest in this paper is (1) whether sex differences exist in maternal responsiveness and (2) whether the measure of maternal responsiveness is sensitive enough to pick up sex differences in a normal population as well as differences in a

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treatment versus nontreatment population of children and mothers. With regard to the first question, we are specifically interested in whether there are sex differences in the degree to which frequency of infant vocalizations are affected by maternal responsiveness.

Existing research findings clearly indicate that parents vocalize more to their daughters than to their sons. Fathers and mothers talk more to their 7-week-old daughters (Moss, 1974) and mothers more often imitate their 3-month-old daughters (Moss, 1967).

Girls are typically more sensitive to or influenced by vocal and auditory stimuli than are boys. Auditory reinforcement increases the learning of 10-week-old girls whereas visual stimuli are more effective for boys (Watson, 1969). Girls vocalize more to social than to nonsocial stimuli whereas boys vocalize similarly to both social and nonsocial stimuli at 6 months of age (Lewis, Kagan, & Kalafat, 1966) and at 8- and 12-months of age (Kagan, 1971). Similarly 13-month-old girls vocalize more to auditory stimuli, whereas there are no sex differences in vocalization to visual stimuli (Kagan & Lewis, 1965).

When both amount of infant vocalization and speed of maternal vocal response are measured at one month of age, the amount of boys vocalization is a better predictor of their vocalization at 3 months, whereas for girls maternal responsiveness at one month is

the better predictor of 3-month-old vocalization, in a conditioning experiment (Moss, 1974).

A major question related to the above findings is whether or not there are sex differences in amount of infant vocalization. Certainly, children who vocalize more frequently are found to have shorter pauses between their speech and that of their mothers, if frequency of maternal vocalization is held constant. The literature on the subject is somewhat unclear. Moss (1974) found 1- and 3-month-old boys vocalized more whereas Goldberg and Lewis (1969) found 13-month-old girls vocalized a greater amount than did boys. However, no sex differences in vocalization were found by Moss (1974) for 7-week-old infants. This raises some interesting questions as to whether Moss' (1974) finding that maternal responsiveness predicts amount of vocalization at 3 months for girls but not boys was due to the sex difference in frequency of vocalizations that were found.

In the present study, children and their mothers were and are being videotaped at 2 weeks, 6 weeks, 3, 6, 9, 12, 15, 18, and 24 months of age. The children are all within plus or minus 1 week of their target age when videotaped. Children will be followed up to 5 years of age to obtain various outcome data. Videotaping occurs behind a one-way mirror while each dyad interacts for 5 minutes in each of 6 typical situations: an unstructured waiting period, free play, diapering, teaching, feeding, and while the mother fills out a questionnaire.

Complete data exists on 80 children who have been videotaped to date, divided into four groups of male and female first- and later-born children. The children in the four groups are similar on the Bayley Scales of Infant Development, ranging, for example, from scores of 118 to 122 on the Mental Development Index and from 101 to 108 on the Psychomotor Development Index at 12 months of age. The children have no labor, delivery or birth complications and were all vaginal deliveries. Their birth weight ranged between 6 pounds and 8 pounds, 8 ounces with a gestational age ranging from 38 to 42 weeks. The children's mothers are also a very homogeneous group: middle socio-economic status, an educational level ranging from 14 to 16 years, a mean age of 26 years (ranging from 23 to 33 years), married, and expected residence in Madison of 5 years.

The data to be reported here today are based on 5 male and 5 female later-born children and their mothers, videotaped at 2, 26, 52, and 78 weeks of age during a 4.67-minute free-play session during which mothers were instructed to play with their children as they normally would at home.

The speech parameters that were analyzed in the present study were: (1) length of joint silences (speaker switch pauses, and hesitation pauses), and (2) uninterrupted vocalizations. Amount of simultaneous speech (or interruptions) was also measured but occurred so infrequently that it was not analyzed.

The data for this study were recorded on a 6 channel event recorder. Three channels were used to record maternal vocalization, maternal verbalization, and infant vocalization. When one of these three keys was depressed it would record the onset, the duration and the offset (when the key was released) of any vocalizations or verbalizations occurring on the videotape. This technique allowed us not only to get exact durations of utterances but also to measure rather precisely the speaker switch pauses and hesitation pauses. Prior to recording the data of the present study, inter-recorder reliability was obtained on 9 tapes and ranged from a correlation of .80 to .91 for the various utterance and pause categories.

Data from Jaffe and Feldstein (1970) indicates that, for adult dyadic conversation, the consistency within a conversation for uninterrupted vocalizations is .76 ($p < .05$), for hesitation pauses it is .71 ($p < .05$) and for speaker switch pauses it is .72 ($p < .05$). Stability from the first day to the eighth day with the same partner for uninterrupted vocalizations was .72 ($p < .05$), for hesitation pauses was .40 ($p < .05$) and for speaker switch pauses was .51 ($p < .05$). When the typical duration of a speaker's vocalizations and pauses were compared with one partner on day one and a different partner on day eight, the value for the uninterrupted vocalizations remains similar, .71, while that for simultaneous speech, hesitation pauses and speaker switch pauses

drops to below significance level. This is also true for these parameters under stress and nonstress situations. This indicates that duration of vocalizations is a relatively stable feature of a speaker, whereas hesitation pauses, speaker switch pauses, and simultaneous speech tend to be more influenced by the temporal patterning of the speaker's partner as well as other characteristics of the situation.

Since, in the present study, the vocalization data of the same dyads were analyzed at each of the four ages, some preliminary data on stability over time for the parameters being studied are available (the Kendall Coefficient of Concordance was used to test for significance): (1) males evidence significant stability across the four ages on frequency of infant vocalization, and child to mother speaker switch pauses; (2) females evidenced significant stability over the four ages on mother to child speaker switch pauses.

In the present study we found that mothers vocalized and verbalized more to their daughters than to their sons at 26, 52, and 78 weeks of age (Mann-Whitney U Test at each age, $p < .05$). At 2 weeks of age, however, amount of maternal speech is similar for boys and girls (see Figure 1). During the 4.67-minute free-play period, the mothers of girls vocalized to their daughters an average of 33% of the time, whereas mothers of boys vocalized to their sons an average of 25% of the time.

The interpretation of the above data, of course, hinges upon whether or not girls present greater amounts of vocal stimuli to their parents than do boys. However, no sex differences in amount of infant vocalization were found at any of the ages: 2, 26, 52, or 78 weeks of age. Furthermore, boys and girls vocalized roughly the same amounts at each age, with the youngest children vocalizing the most. Girls vocalized 7.6% of the time and boys 8.4% of the time on the average, during a 4.67-minute free-play.

Mean duration of various pause times was next analyzed. Responsiveness of the mother (or child to mother speaker switches, and child hesitation) were investigated. It was found that mothers responded more quickly with a vocalization to their female children's vocalizations at 26, 52, and 78 weeks of age. At 2 weeks of age, mothers responded more quickly to their sons utterances.

One question of importance in this study was to determine whether there were sex differences when degree of maternal responsiveness and frequency of infant vocalizations were correlated. The answer appears to be yes. For girls there is a high correlation between frequency of female vocalization and rapidity of maternal vocal response which just misses significance. This strong trend exists at all four ages analyzed.

For boys, however, there is either no correlation between maternal responsiveness and infant vocalization (at 2, 26, and 78 weeks) or a significant negative correlation (at 52 weeks). That is, maternal responsiveness does not seem to be related to the vocalization frequency of boys. Boys do not seem to be following reinforcement theory, and these sex differences are present as early as 2 weeks of age.

We wondered whether the above sex differences could be explained by the fact that girls were more reinforcing to their mothers. That is, did the little girls respond more quickly with vocalizations to their mothers vocalizations than did the boys? This does not seem to be the case: in the present study no clear sex trend is evident; males and females appear to be similarly reinforcing to their mothers in terms of how soon they vocalize after their mothers vocalize.

The conclusion one must draw from this is that the frequency of boys' vocalization is apparently independent of maternal responsiveness whereas girls are more influenced by maternal or vocal reinforcement.

We were further interested in determining how rapidity of maternal vocal response to infant vocalization would correlate with frequency of infant vocalization in a treatment population. A group of 5 12-month-old treatment children (3 girls and 2 boys) who were healthy as neonates and born to emotionally disturbed

parents were found to vocalize substantially less (45%) than the normative group (from the Infant Study Project) and their mothers also vocalized less to them (45%-55% less). The amount of time it took the treatment mothers to respond to their children's vocalizations was substantially longer, i.e., 2 1/2 to 4 times as long as mothers in the normative population. Likewise, there was no correlation between frequency of infant vocalization and maternal responsiveness. This is in the expected direction for the treatment population of mothers known to be typically unresponsive to their children.

What conclusions for treatment can we draw from this for treatment and for research? For treatment, it means parents must be taught to be sensitive to their child's cues; they must be given support to be responsive to children that are more difficult-irritable-harder to read. For research, it means that this particular measure of maternal responsiveness appears to be a valid measure of the broader concept of maternal sensitivity.

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FIGURE 1. MOTHER AND CHILD VOCALIZATIONS/VERBALIZATIONS DURING A 4.67 MINUTE VIDEOTAPED FREE-PLAY PERIOD